|  |  |
| --- | --- |
| **Subject Area: PHYSICAL SCIENCE** | **Grade Level: 3-4** |

**National Standards**

* CONTENT STANDARD B: As a result of the activities in grades K-4, all students should develop an understanding of
  + Properties of objects and materials
  + Position and motion of objects
    - The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

**Objectives**

* These activities are designed to give grades 3 and 4 experiences in using simple machines.

**Estimated Time**

* 2-3 class periods

**Outcomes**

* Demonstrate an awareness of the types of simple machines and be able to classify common objects in relation to the simple machines involved.

**Resources**

* Internet connection
* Paper, pencils, glue, and misc classroom supplies

**Assessment**

* Students will share the results of their activity journals

***SCREW***

### Objectives: Show that a screw is an inclined plane. Time: :40 Materials: paper, pencil, tape, crayon

### http://www.grc.nasa.gov/WWW/k-12/Summer_Training/KaeAvenueES/THREADS.GIF

### Prediction-Hypothesis-Question: How do you make a screw?

### Procedure: Step 1: Give each group of students the materials. (paper, scissors, tape, new pencil) Step 2: Give each student a paper right-triangle and have the longest side colored. Trim out. Step 3: Line up the shortest uncolored sides of the triangle to the pencil. Step 4: Wrap the triangle around the pencil and tape down. Step 5: The triangle wraps in a spiral. Gently pinch/hold your two fingers at one end and twist the pencil with the other. What happens? Record your observations with pictures and words in your Science Journal. http://www.grc.nasa.gov/WWW/k-12/Summer_Training/KaeAvenueES/pencil_screw.gif

### Record Results:

Share their results.  
The right triangle is an inclined plane.  
**Conclusion:**A screw is an inclined plane that is wrapped around a center pole.

### Extensions:

Look at roads that zig-zag down mts. or spiral around them.  
Which path is greater? The distance up the pencil or the length of the edge of the triangle.  
Take different types of screws and see how many turns it takes to get the screw in a block of wood.

***INCLINED PLANE***

**Objectives:**Inclined planes make it easier to move things. **Time:**1 class time  
**Materials:**5-6 books  
Ruler  
small bag filled with about 1 cup of rice or dried beans closed with a twist tie  
rubber band  
**Prediction-Hypothesis-Question:**Which will be easier--moving the bag using the inclined plane or moving it by lifting straight up. **Procedure:**Stack the books. Lean one of the books against the the stack to make an inclined plane.  
Cut rubber band and tie it to the neck of the sack.  
Holding one end of the rubber band , lift the bag straight up to the top of the books**.**Measure the length of the stretched rubber strip.  
Put the bag at the bottom of the inclined book.  
Hold the end of the rubber strip, slowly pull the bag up the plane  
Measure the length of the stretched rubber strip when the bag is almost at the top.  
**Record Results:**Write the length of the rubber strip.  
Make a class chart to compare information. **Conclusion:**The farther the rubber strip stretched the more force was being used. **Extensions:**Attach a spring scale to the free end of the rubber strip to find the amount of effort.

***A WEDGE***

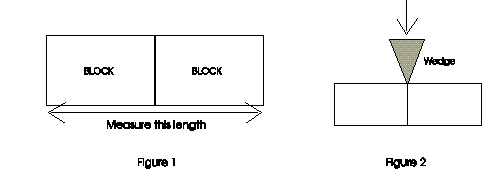
# INCLINED PLANE 2

## MATERIALS

* 2 wood blocks
* 1 fat wedge
* 1 skinny wedge
* 1 ruler

## PROCEDURE

1. Put the blocks side by side on your desk. Use your ruler to measure how long the two blocks are. (See Figure 1.)



2. Record the length below. Remember to write the units.

|  |  |
| --- | --- |
| **WEDGE** | **LENGTH** |
| No Wedge | http://www.galaxy.net/%7Ek12/blank.gif |
| Skinny Wedge | http://www.galaxy.net/%7Ek12/blank.gif |
| Fat Wedge | http://www.galaxy.net/%7Ek12/blank.gif |
|  |  |

3. Place the skinny wedge where the blocks meet and push down as shown in Figure 2. Now measure and record the length of the blocks.

4. Put the two blocks back together and repeat step 3 using the fat wedge. Measure and record the length of the blocks.

## QUESTIONS

When you pushed down on the wedge, which way did the blocks move?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How does the thickness of the wedge affect the movement of the blocks?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***PULLEY***

**Objectives:**

To see that the number of strings of a pulley decrease the amount of effort needed to lift an object.

**Time:**

One-two class times.

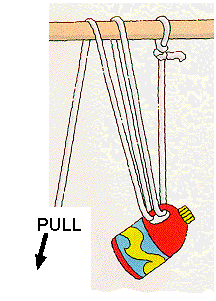
**Materials:**

Per group-broom handle,jug with a closed handle filled with sand or water, twine or rope, duct tape.

**Prediction-Hypothesis-Question:**

What is the easiest way to lift the jug?

**Procedure:**

Have the students tape the ends of the broom handle down between 2 desk tops.  
Allow the students to try several ways to lift the jug using the rope and broom handle.  
share their results  
Day Two:  
Now, have the students tie the rope to the broom handle, loop the rope through the jug handle, and lift by the free end of the rope with the weight in the middle(movable pulley).  
Loop the rope over the broom handle and pull down on the the free end. Record the effort.  
[](http://www.grc.nasa.gov/WWW/k-12/Summer_Training/KaeAvenueES/Pulley_jug.GIF)Now loop the rope through the jug handle another time and then up and over the broom handle. You will have 2 loops over the broom and the original not.

**Record Results:**

Students share results that they have recorded in their journals.

**Conclusion:**

They will see that the more times the rope is looped through the jug and over the broom handle, the less effort needed.

**Extensions:**

Find small jugs for the students to pull up with strings and use spring scales to measure the force needed.

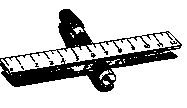
***A SLIDE – the GIANT PLANE***

**Objectives:**An inclined plane makes it easier to move things. **Time:**One class period **Materials:**Playground slide  
5 large books  
1 long jump rope  
Plastic grocery sack **Prediction-Hypothesis-Question:**What is the best way to get 5 heavy books to the top of the slide? **Procedure:**Put the books in the grocery sack and tie the rope to the handles.  
Have the students climb to the top of the slide and then pull the books straight up by the rope.  
Now have the books placed at the bottom of the slide.  
Have the students pull the books to the top of the slide.  
Have them consider the force that they are using each time.  
**Record Results:**Have students write/draw a comparison about the two ways that the books got to the top of the slide. **Conclusion:**Students will conclude that the inclined plane was easier .  
What you gain in effort, you pay in distance. **Extensions:**How could they adapt the experiment.  
Discuss ways that the inclined plane is commonly used.  
**Assessment:**Have students draw a picture of someone using an inclined plane. Write sentences to explain.  
Show students pictures and have them find inclined planes

***LEVERS***

**Objectives**  
The closer a load is to the fulcrum, the less effort is needed.  
The less effort means more distance to move the effort.  
Work is the amount of force times the distance(how far down you had to push). **Time:**1-2 class periods **Materials:**Desk, ruler or meter stick,weight(apple, filled film can) **Prediction-Hypothesis-Question:**Does it make a difference on the ruler where you place a load when trying to lift it? **Procedure:**Have students explore with ruler and a weight.  
Have them put ruler on a disk with different lengths of the ruler hanging over the edge of the desk.  
Or have the students put the 4 inch mark on the edge of the desk. Put the weight on 12 inches. Push down on the ruler.  
Now put the 8 in. mark at the edge of the desk. Push down. **Record Results:**Have students record results as to how much effort was needed. **Extensions:**Have them now measure how far they have to push down to lift the weight 3 inches.  
Have them move the load closer to the fulcrum.  
Intro. that Work(lifting the weight)=Force(how hard you had to push down on the ruler) X the Distance(how far down you had to push the ruler)

## Tiny Levers

**Materials Per Group**:  
12-inch ruler  
large marker  
tape  
post-it pad  
**Predict-Hypothesis**:  
What will happen when a pad of paper is placed on one end of a lever?  
P**rocedure**:  
Tape the marker on the table. Balance the ruler on top of the marker. Rest the ruler on the marker at the 6 inch line.  
Place the pad of paper on different spots on the ruler. Push down on the opposite end of the ruler.  
**Record Results**:  
Primary-Draw pictures showing what happened in each step.  
Intermediate-Draw diagrams of your experiment.  
Make an organized chart or graph that shows the results of the experiment.  
Make sure journaling is done.  
**Conclusions**:  
Share information. Did the results support your prediction?  
What does this activity teach you about levers and work.  
When was it easier to lift the pad of paper.  
**Extensions**:  
Design another experiment to show how levers work.  
Design an experiment to lift a book 6 inches.  
List any questions they might have. These could be used to develop other experiments.

## Catapult Shooter

**Materials per group**:  
Popsicle stick  
meter stick or tape  
CheeriOs or other cereal  
pencil  
small cups  
**Prediction-Hypothesis**:  
How can you consistantly get cereal into a cup “X” inches away?  
**Procedure**:  
Let students design experiment using the materials listed.  
Put the Popsicle stick across the pencil.  
Put a piece of cereal on the end of the stick touching the floor. Flip the cereal by hitting the stick end that is in the air.  
Mark where the pencil(fulcrum) is.  
Record the distance in an organized chart.  
Change the location of the fulcrum. Record.  
Now have groups try to get the cereal into a cup “X” inches from catapult.  
**Record Results**:  
Make a chart of your trials.  
Explain how you succeeded at hitting the cup.  
Write about your experiment.  
**Conclusions**:  
How does placement of the fulcrum effect experiment?  
Were there other variables that affected the catapult?  
**Extensions:**  
Set up other experiments testing variables.  
How could this be used for work?

RESOURCE CHART

|  |  |  |  |
| --- | --- | --- | --- |
| **SIMPLE MACHINES** | **WHAT IT IS** | **HOW IT HELPS**  **US WORK** | **EXAMPLES** |
| **LEVER** | A stiff bar that rests on a support called a fulcrum | Lifts or moves loads | Shovel, nutcracker, seesaw,crowbar,elbow,tweezers,bottle opener |
| **INCLINED PLANE** | A slanting surface connecting a lower level to a higher level | Things move up or down it | Slide, stairs, ramp, escalator, slope |
| **WHEEL AND AXEL** | A wheel with a rod, called an axel, through its center: both parts move together | Lifts or moves loads | Car, wagon, doorknod, pencil sharpener, bike |
| **SCREW** | An inclined plave wrapped around a pole | Holds things together or lifts | Screw, jar lid, vise, bolt, drill, corkscrew |
| **PULLEY** | A grooved wheel with a rope or cable around it | Moves things up, down, or across | Curtain rod, tow truck, mini-blind, flag pole, crane |
| **WEDGE** | An object with at least one slanting side ending in a sharp edge | Cuts or spreads an object apart | Knife, pin, nail, chisel,ax, snowplow, front of a boat |